invention have a total transition metal content of less than about 20 ppm, more preferably less than about 5 ppm, as measured by Weyerhaeuser Test Number AM5—PULP-1/6010. The term "total transition metal content" refers to the combined amount, expressed in units of parts per million (ppm), of nickel, chromium, manganese, iron and copper. Preferably the iron content of lyocell fibers of the present invention is less than about 4 ppm, more preferably less than about 2 ppm, as measured by Weyerhaeuser Test AM5-PULP-1/6010, and the copper content of lyocell fibers of the present invention is preferably less than about 1 ppm, more preferably less than about 0.5 ppm, as measured by Weyerhaeuser Test AM5-PULP-1/6010.

Preferred embodiments of the lyocell fibers of the present invention possess desirable elongation properties. Preferably, lyocell fibers of the present invention possess a dry elongation of from about 8% to about 17%, more preferably from about 12% to about 15%. Preferably, lyocell fibers of the present invention possess a wet elongation of from about 12% to about 18%. Elongation is measured by means of proprietary assays performed by Thuringisches Institut fur Textil-und Kunstoff Forschunge. V., Breitscheidstr. 97, D-07407 Rudolstadt, Germany. Lyocell fibers produced from treated pulps of the present invention have exhibited dry tenacities on the order of about 40-42 cN/tex and wet tenacities on the order of 30-33 cN/tex as measured by the proprietary assays performed by Thuringisches Institut fur Textil-und Kunstoff Forschunge. V., Breitscheidstr.

In another aspect, the present invention provides processes for making compositions of the present invention that can, in turn, be formed into lyocell molded bodies, such as fibers or films. In this aspect, the present invention provides a process that includes contacting an alkaline pulp comprising cellulose and at least about 7% hemicellulose under alkaline conditions with an amount of an oxidant sufficient to reduce the average D.P. of the cellulose to within the range of from about 200 to about 1100, preferably to within the range of from about 300 to about 1100, more preferably to within the range of from about 400 to about 700, without substantially reducing the hemicellulose content or increasing the copper number. Pulps which are to be treated according to the present invention with an oxidant to achieve the D.P. reduction without substantially reducing the hemicellulose content or increasing the copper number as discussed above preferably have a kappa number less than 40, more preferably less than

30 and most preferably less than 25 when they are contacted for the first time with the oxidant.

This D.P. reduction treatment can occur after the pulping process and before, during or after the bleaching process, if a bleaching step is utilized. The oxidant under alkaline conditions is any oxidant containing a peroxide group such as hydrogen peroxide, oxygen, chlorine dioxide and ozone. Preferably the oxidant is a combination of oxygen and hydrogen peroxide, or hydrogen peroxide alone.

Preferably the carbohydrate yield of the D.P. reducing step of the present invention is greater than about 95%, more preferably greater than about 98%. The process yield is the dry weight of the treated pulp produced by the process divided by the dry weight of the starting material pulp, the resulting fraction being multiplied by one hundred and expressed as a percentage.

In another aspect of the present invention a process for making lyocell fibers includes the steps of (a) after the pulping process, contacting an alkaline pulp including cellulose and at least about 7% hemicellulose with an amount of an oxidant sufficient to reduce the average degree of polymerization of the cellulose to the range of from about 200 to about 1100, preferably to the range of from about 300 to about 1100, without substantially reducing the hemicellulose content or increasing the copper number of the pulp; and (b) forming fibers from the pulp treated in accordance with step (a). In accordance with this aspect of the present invention, the lyocell fibers are preferably formed by a process selected from the group consisting of melt blowing, centrifugal spinning, spun bonding and a dry jet/wet process.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing aspects and many of the attendant advantages of this invention will become more readily appreciated as the same become better understood by reference to the following detailed description, when taken in conjunction with the accompanying drawings, wherein:

FIGURES 1A-1C are block diagrams of the presently preferred processes for converting pulp, preferably an alkaline pulp, to a composition of the present invention useful for making lyocell molded bodies, combinations of FIGURES 1A-1C could also be employed;

FIGURE 2 is a block diagram of the steps of the presently preferred process of forming fibers from the compositions of the present invention; and

FIGURES 3 and 4 are scanning electron micrographs at 100X and 10,000X magnification of a dry jet/wet lyocell fiber produced, as set forth in Example 11, from treated pulp of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

U.S. Application No. 09/574,538, is herein expressly incorporated by reference. Starting materials useful in the practice of the present invention contain cellulose and hemicellulose. Examples of starting materials useful in the practice of the present invention include, but are not limited to, trees and recycled paper. The starting materials used in the practice of the present invention, from whatever source, are initially converted to a pulp using an alkaline pulping process, such as the Kraft or soda process. The presently preferred starting material in the practice of the present invention is an alkaline chemical wood pulp, preferably an unbleached Kraft wood pulp, or a bleached Kraft wood pulp containing cellulose and at least about 7% hemicellulose, that has not been exposed to acid hydrolysis conditions or any other heterogeneous mixture conditions (i.e., reaction time, temperature, and acid concentration), where cellulose glycosidic bonds are broken. The discussion of the preferred embodiment of the present invention that follows will refer to the starting material as pulp or pulped wood, but it will be understood that the specific reference to wood as the source of starting material pulp in the following description of the preferred embodiment of the present invention is not intended as a limitation, but rather as an example of a presently preferred source of hemicellulose and cellulose.

In order to distinguish between the pulp that is useful as a starting material in the practice of the present invention (such as a bleached or unbleached, alkaline Kraft wood pulp) and the compositions of the present invention (that are produced by treating the starting material, in order to reduce the average D.P. of the starting material pulp without substantially reducing the hemicellulose content or increasing the copper number of the starting material pulp), the latter will be referred to as "composition(s) of the present invention", or "composition(s) useful for making lyocell fibers", or "treated pulp" or "treated Kraft pulp."